<u>Claims</u>

1   1.   A method for retrieving digital objects from a group of digital objects

2   maintained by a database, the group of digital objects being represented by the equation

3    $G = \{m_i, i = 1, 2, ..., N\}$, wherein G represents the group of digital objects, N represents

4   the number of digital objects maintained by the database, i represents an index having

5   allowable values between 1 and N inclusive, and m_i represents an ith digital object

6   within the group of digital objects, the method comprising:

7   generating a random number R and keys k_i, i having allowable values between 1

8   and N inclusive, for a symmetric key cryptosystem;

9   determining a prime number p;

10   encrypting digital object m_i with key k_i using the symmetric key cryptosystem to

11   obtain ciphertext c_i;

12   assigning a value of $k_i^R \bmod p$ to a key ciphertext s_i;

13   responsive to the database receiving a request signal from a user, sending c_i, and

14   s_i to the user;

15   receiving from the user a number n of input signals W_j, such that n is less than N,

16   and j is an index having allowable values between 1 and n inclusive;

17   computing changed ciphertext U_j, such that U_j is equal to $W_j^{1/R \bmod (p-1)} \bmod p$; and

18   sending U_j to the user.

1   2.   The method of claim 1, where the modulo operations may be carried out

2   in any group in which a discrete logarithm is infeasible to compute.

1   3.   A method for a user to privately retrieve digital objects from a group of

2 digital objects $G = \{ m_i, i = 1, 2, ..., N)$ maintained by a database, the method comprising

3 the steps of:

4   sending a request signal to the database;

5   receiving reply signals $c_l, s_l, l = 1, 2, ..., N$ from the database;

6   generating random numbers w_j, computing and sending $W_j = s_{i_j}^{w_j} \bmod p, j = 1, 2,$

7   ..., n to the database;

8   receiving signals $U_j, j = 1, 2, ..., n$ from the database;

9   computing $k_{i_j} = Uj^{1/w_j \bmod (p-1)} \bmod p, j = 1, 2, ..., n;$ and

10   decrypting c_{i_j} with k_{i_j} and a symmetric key cryptosystem to recover digital objects

11          $m_{i_j}, j = 1, 2, ..., n.$

1   4.   The method of claim 3, wherein the modulo operations may be carried out

2 in any group in which a discrete logarithm is infeasible to compute.

1   5.   A method for selectively retrieving digital objects from a database of

2 digital objects using a symmetric key cryptosystem, the method comprising:

3   for each digital object in the database:

4   generating a unique key for the symmetric key cryptosystem;

5   associating the key with the digital object;

6   encrypting the digital object using the associated key and the

7   symmetric key cryptosystem to produce a ciphertext of the

8   digital object;

9   encrypting the associated key to obtain a ciphertext of the key;

10   transmitting the ciphertext of the digital object and the ciphertext of

11   the key associated with the digital object to a user;

12	receiving at least one changed ciphertext of the keys associated with the digital
13	objects in the database;
14	decrypting each received changed ciphertext; and
15	transmitting the decrypted received changed ciphertexts.
16	

1	6. A method for retrieving digital objects from a group of digital objects
2	maintained by a database, the method comprising the steps of:
3	selectively requesting a plurality of digital objects from the database;
4	receiving encrypted ciphertext digital objects from the database;
5	receiving from the database encrypted ciphertext keys associated with the
6	received ciphertext digital objects;
7	encrypting at least one of the encrypted ciphertext keys to obtain changed
8	ciphertext keys;
9	sending the changed ciphertext keys to the database;
10	receiving partially decrypted changed ciphertext keys from the database;
11	decrypting the partially decrypted changed ciphertext keys; and
12	decrypting at least one of the received ciphertext digital objects using the
13	decrypted keys.

1	7. An apparatus comprising:
2	a computerized database;
3	coupled to the database, a computer user;
4	coupled to the database, a transmitting module for transmitting data to the user;
5	coupled to the database, a receiving module for receiving data from the user;
6	coupled to the database, a random number generating module for generating
7	random numbers;

8	coupled to the database, a key generating module for generating cryptographic
9	keys;
10	coupled to the database, an encrypting module for encrypting data;
11	coupled to the database, a decrypting module for decrypting data;
12	coupled to the user, a requesting module for requesting data from the database;
13	coupled to the user, a transmitting module, for transmitting data to the database;
14	coupled to the user, a receiving module, for receiving data from the database;
15	coupled to the user, a random number generating module for generating random
16	numbers;
17	coupled to the user, an encrypting module for encrypting data; and
18	coupled to the user, a decrypting module for decrypting data.

1	8. A computer program product stored on a computer readable medium for
2	retrieving digital objects from a group of digital objects maintained by a database, the
3	computer program product controlling a processor coupled to the medium to perform
4	the operations of:
5	for each digital object in the database:
6	generating a unique key for a symmetric key cryptosystem;
7	associating the key with the digital object;
8	encrypting the digital object using the associated key and the
9	symmetric key cryptosystem to produce a ciphertext of the
10	digital object;
11	encrypting the associated key to obtain a ciphertext of the key;
12	transmitting the ciphertext of the digital object and the ciphertext of
13	the key associated with the digital object to a user;
14	receiving at least one changed ciphertext of the keys associated with the digital
15	objects in the database;

16   decrypting each received changed ciphertext; and

17   transmitting the decrypted received changed ciphertexts.